

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims:

1. (Currently Amended) A method of performing an injection operation comprising the steps of:

introducing a water-soluble relative permeability modifier comprising a hydrophobically modified water-soluble polymer into a subterranean formation zone having a permeability to aqueous-based fluids so that the hydrophobically modified water-soluble polymer reduces the permeability of the subterranean formation zone to aqueous-based fluids, wherein the hydrophobically modified water-soluble polymer has a molecular weight in the range of about 100,000 to about 10,000,000 once synthesized and comprises a polymer backbone and a hydrophobic branch, the hydrophobic branch comprising an alkyl group of from about 4 carbons to 22 carbons without any intervening heteroatoms; and

injecting an aqueous injection fluid into the subterranean formation zone after introducing the water-soluble relative permeability modifier so that the hydrophobically modified water-soluble polymer present in the subterranean formation zone diverts at least a portion of the aqueous injection fluid to another subterranean formation zone.

2. (Canceled)

3. (Original) The method of claim 1 wherein the hydrophobically modified water-soluble polymer comprises a polymer backbone comprising polar heteroatoms.

4. (Currently Amended) The method of claim 3 wherein the polar heteroatoms present within the polymer backbone of the hydrophobically modified water-soluble polymer comprise at least one atom selected from the group consisting of: oxygen, ~~nitrogen~~, sulfur, and phosphorous.

5. (Original) The method of claim 1 wherein the hydrophobically modified water-soluble polymer is a reaction product of a hydrophilic polymer and a hydrophobic compound.

6-9. (Canceled)

10. (Original) The method of claim 5 wherein the hydrophilic polymer comprises a polymer backbone comprising polar heteroatoms.

11. (Previously Presented) The method of claim 10 wherein the hydrophilic polymer comprises at least one polymer selected from the group consisting of: a cellulose, a chitosan, a polyamide, a polyetheramine, a polyethyleneimine, a polyhydroxyetheramine, a polylysine, a polysulfone, and a starch.

12. (Previously Presented) The method of claim 5 wherein the hydrophobic compound comprises at least one compound selected from the group consisting of: an alkyl halide, a sulfonate, a sulfate, and an organic acid derivative.

13. (Previously Presented) The method of claim 12 wherein the organic acid derivative comprises at least one organic acid derivative selected from the group consisting of: an octenyl succinic acid, a dodecenyl succinic acid, an anhydride of octenyl succinic acid, an ester of octenyl succinic acid, an amide of octenyl succinic acid, an anhydride of dodecenyl succinic acid, an ester of dodecenyl succinic acid, and an amide of dodecenyl succinic acid.

14. (Previously Presented) The method of claim 5 wherein the hydrophobic compound has an alkyl chain length of about 4 to about 22 carbons.

15-20. (Canceled)

21. (Original) The method of claim 1 wherein the hydrophobically modified water-soluble polymer is prepared from a polymerization reaction of at least one hydrophilic monomer and at least one hydrophobically modified hydrophilic monomer.

22-23. (Canceled)

24. (Previously Presented) The method of claim 21 wherein the mole ratio of the hydrophilic monomer to the hydrophobically modified hydrophilic monomer in the hydrophobically modified water-soluble polymer is in the range of about 99.98:0.02 to about 90:10.

25. (Previously Presented) The method of claim 1 wherein the water-soluble relative permeability modifier is introduced into the subterranean formation zone by injecting a permeability-modifying injection fluid comprising an aqueous injection fluid and the water-soluble relative permeability modifier into the subterranean formation zone.

26. (Previously Presented) The method of claim 25 wherein the water-soluble relative permeability modifier is present in the permeability-modifying injection fluid in an

amount in the range of about 0.02% to about 10% by weight of the permeability-modifying injection fluid.

27. (Original) The method of claim 25 wherein the permeability-modifying injection fluid was formed by metering the water-soluble relative permeability modifier into an existing injection stream comprising the aqueous injection fluid to form the permeability-modifying injection fluid.

28. (Previously Presented) The method of claim 1 wherein the water-soluble relative permeability modifier is introduced into the subterranean formation zone by injecting a treatment fluid comprising the water-soluble relative permeability modifier into the subterranean formation zone.

29. (Previously Presented) The method of claim 28 wherein the water-soluble relative permeability modifier is present in the treatment fluid in an amount in the range of about 0.02% to about 10% by weight of the treatment fluid.

30-99. (Canceled)

100. (Previously Presented) The method of claim 5 wherein the hydrophilic polymer comprises a dialkyl amino pendant group.

101. (Previously Presented) The method of claim 5 wherein the hydrophilic polymer comprises a dimethyl amino pendant group and at least one monomer selected from the group consisting of: dimethylaminoethyl methacrylate and dimethylaminopropyl methacrylamide.

102. (Previously Presented) The method of claim 5 wherein the hydrophilic polymer comprises at least one polymer selected from the group consisting of: a polyvinylamine, a poly(vinylamine/vinyl alcohol), and an alkyl acrylate polymer.

103. (Previously Presented) The method of claim 5 wherein the hydrophilic polymer comprises at least one polymer selected from the group consisting of: polydimethylaminoethyl methacrylate, polydimethylaminopropyl methacrylamide, poly(acrylamide/dimethylaminoethyl methacrylate), poly(acrylic acid/dimethylaminoethyl methacrylate), poly(methacrylic acid/dimethylaminoethyl methacrylate), poly(2-acrylamido-2-methyl propane sulfonic acid/dimethylaminoethyl methacrylate), poly(acrylamide/dimethylaminopropyl

methacrylamide), poly(acrylic acid/dimethylaminopropyl methacrylamide), and poly(methacrylic acid/dimethylaminopropyl methacrylamide).

104. (Previously Presented) The method of claim 21 wherein the hydrophilic monomer comprises at least one monomer selected from the group consisting of: acrylamide, 2-acrylamido-2-methyl propane sulfonic acid, N,N-dimethylacrylamide, vinyl pyrrolidone, dimethylaminoethyl methacrylate, acrylic acid, dimethylaminopropylmethacrylamide, vinyl amine, vinyl acetate, trimethylammoniummethyl methacrylate chloride, methacrylamide, hydroxyethyl acrylate, vinyl sulfonic acid, vinyl phosphonic acid, methacrylic acid, vinyl caprolactam, N-vinylformamide, N,N-diallylacetamide, dimethyldiallyl ammonium halide, itaconic acid, styrene sulfonic acid, methacrylamidoethyltrimethyl ammonium halide, a quaternary salt derivative of acrylamide, and a quaternary salt derivative of acrylic acid.

105. (Previously Presented) The method of claim 21 wherein the hydrophobically modified hydrophilic monomer comprises at least one monomer selected from the group consisting of: an alkyl acrylate, an alkyl methacrylate, an alkyl acrylamide, an alkyl methacrylamide, an alkyl dimethylammoniummethyl methacrylate halide, and an alkyl dimethylammoniumpropyl methacrylamide halide, wherein the alkyl groups have from about 4 to about 22 carbon atoms.

106. (Currently Amended) A method of performing an injection operation comprising the steps of:

introducing a relative permeability modifier comprising a hydrophobically modified water-soluble polymer into a subterranean formation zone having a permeability to aqueous-based fluids, ~~wherein the hydrophobically modified water-soluble polymer has a molecular weight in the range of about 100,000 to about 10,000,000, wherein the~~ hydrophobically modified water-soluble polymer comprises a polymer backbone and ~~[[,]]~~ a ~~dialkyl~~ an amino pendant group quaternized to include ~~, and~~ a hydrophobic branch, the hydrophobic branch comprising an alkyl group of from about 4 carbons to 22 carbons without any intervening heteroatoms, and wherein the hydrophobically modified polymer reduces the permeability of the subterranean formation zone to aqueous-based fluids without substantially reducing a permeability of the subterranean formation zone to hydrocarbons; and

introducing an aqueous injection fluid into the subterranean zone, wherein the hydrophobically modified water-soluble polymer present in the subterranean formation zone diverts at least a portion of the aqueous injection fluid to a second subterranean formation zone so that the aqueous injection fluid drives hydrocarbons present in the second subterranean formation zone to one or more production wells.

107-110. (Canceled)

111. (Previously Presented) The method of claim 106 wherein the hydrophobically modified water-soluble polymer is a reaction product of a hydrophilic polymer and a hydrophobic compound.

112. (Previously Presented) The method of claim 111 wherein the hydrophilic polymer comprises a dialkyl amino pendant group.

113. (Previously Presented) The method of claim 111 wherein the hydrophilic polymer comprises a dimethyl amino pendant group and at least one monomer selected from the group consisting of: dimethylaminoethyl methacrylate and dimethylaminopropyl methacrylamide.

114. (Previously Presented) The method of claim 111 wherein the hydrophilic polymer comprises at least one polymer selected from the group consisting of: a polyvinylamine, a poly(vinylamine/vinyl alcohol), and an alkyl acrylate polymer.

115. (Previously Presented) The method of claim 111 wherein the hydrophilic polymer comprises at least one polymer selected from the group consisting of: polydimethylaminoethyl methacrylate, polydimethylaminopropyl methacrylamide, poly(acrylamide/dimethylaminoethyl methacrylate), poly(acrylic acid/dimethylaminoethyl methacrylate), poly(methacrylic acid/dimethylaminoethyl methacrylate), poly(2-acrylamido-2-methyl propane sulfonic acid/dimethylaminoethyl methacrylate), poly(acrylamide/dimethylaminopropyl methacrylamide), poly(acrylic acid/dimethylaminopropyl methacrylamide), and poly(methacrylic acid/dimethylaminopropyl methacrylamide).

116. (Previously Presented) The method of claim 111 wherein the hydrophilic polymer comprises at least one polymer selected from the group consisting of: a cellulose, a

chitosan, a polyamide, a polyetheramine, a polyethyleneimine, a polyhydroxyetheramine, a polylysine, a polysulfone, and a starch.

117. (Previously Presented) The method of claim 111 wherein the hydrophobic compound comprises at least compound selected from the group consisting of: an alkyl halide, a sulfonate, a sulfate, and an organic acid derivative.

118. (Previously Presented) The method of claim 117 wherein the hydrophobic compound comprises the organic acid derivative, the organic acid derivative comprising at least organic acid derivative selected from the group consisting of: an octenyl succinic acid, a dodecenyl succinic acid, an anhydride of octenyl succinic acid, an ester of octenyl succinic acid, an amide of octenyl succinic acid, an anhydride of dodecenyl succinic acid, an ester of dodecenyl succinic acid, and an amide of dodecenyl succinic acid.

119. (Previously Presented) The method of claim 111 wherein the hydrophobic compound has an alkyl chain length of about 4 to about 22 carbons.

120. (Previously Presented) The method of claim 106 wherein the hydrophobically modified water-soluble polymer is prepared from a polymerization reaction of at least one hydrophilic monomer and at least one hydrophobically modified hydrophilic monomer.

121. (Previously Presented) The method of claim 120 wherein the hydrophilic monomer comprises at least one monomer selected from the group consisting of: acrylamide, 2-acrylamido-2-methyl propane sulfonic acid, N,N-dimethylacrylamide, vinyl pyrrolidone, dimethylaminoethyl methacrylate, acrylic acid, dimethylaminopropylmethacrylamide, vinyl amine, vinyl acetate, trimethylammoniummethyl methacrylate chloride, methacrylamide, hydroxyethyl acrylate, vinyl sulfonic acid, vinyl phosphonic acid, methacrylic acid, vinyl caprolactam, N-vinylformamide, N,N-diallylacetamide, dimethyldiallyl ammonium halide, itaconic acid, styrene sulfonic acid, methacrylamidoethyltrimethyl ammonium halide, a quaternary salt derivative of acrylamide, and a quaternary salt derivative of acrylic acid.

122. (Previously Presented) The method of claim 120 wherein the hydrophobically modified hydrophilic monomer comprises at least one monomer selected from the group consisting of: an alkyl acrylate, an alkyl methacrylate, an alkyl acrylamide, an alkyl methacrylamide, an alkyl dimethylammoniummethyl methacrylate halide, and an alkyl

dimethylammoniumpropyl methacrylamide halide, wherein the alkyl groups have from about 4 to about 22 carbon atoms.

123. (Previously Presented) The method of claim 120 wherein the mole ratio of the hydrophilic monomer to the hydrophobically modified hydrophilic monomer in the hydrophobically modified water-soluble polymer is in the range of about 99.98:0.02 to about 90:10.

124. (Previously Presented) The method of claim 106 wherein the water-soluble relative permeability modifier is introduced into the subterranean formation zone by injecting a permeability-modifying injection fluid comprising an aqueous injection fluid and the water-soluble relative permeability modifier into the subterranean formation zone.

125. (Previously Presented) The method of claim 124 comprising metering the water-soluble relative permeability modifier into an existing injection stream comprising the aqueous injection fluid to form the permeability-modifying injection fluid.

126. (Previously Presented) The method of claim 106 wherein the water-soluble relative permeability modifier is introduced into the subterranean formation zone by injecting a treatment fluid comprising the water-soluble relative permeability modifier into the subterranean formation.

127. (Currently Amended) A method of performing an injection operation comprising the steps of:

introducing a hydrophobically modified water-soluble polymer into a subterranean formation zone having a permeability to aqueous-based fluids, wherein the hydrophobically modified water-soluble polymer has a molecular weight in the range of about 100,000 to about 10,000,000 once synthesized, wherein the hydrophobically modified water-soluble polymer comprises a polymer backbone and a hydrophobic branch, the hydrophobic branch comprising an alkyl group of from about 4 carbons to 22 carbons without any intervening heteroatoms, and wherein the hydrophobically modified water-soluble polymer reduces the permeability of the subterranean formation zone to aqueous-based fluids; and

introducing an aqueous injection fluid into the subterranean formation zone.

128-129. (Canceled)

130. (Previously Presented) The method of claim 127 wherein the hydrophobically modified water-soluble polymer comprises a polymer backbone comprising polar heteroatoms.

131. (Currently Amended) The method of claim 130 wherein the polar heteroatoms present within the polymer backbone of the hydrophobically modified water-soluble polymer comprise at least one atom selected from the group consisting of: oxygen, ~~nitrogen~~, sulfur, and phosphorous.

132. (Previously Presented) The method of claim 127 wherein the hydrophobically modified water-soluble polymer is a reaction product of a hydrophilic polymer and a hydrophobic compound.

133. (Previously Presented) The method of claim 127 wherein the hydrophilic polymer comprises a dialkyl amino pendant group.

134. (Previously Presented) The method of claim 127 wherein the hydrophilic polymer comprises a dimethyl amino pendant group and at least one monomer selected from the group consisting of dimethylaminoethyl methacrylate and dimethylaminopropyl methacrylamide.

135. (Previously Presented) The method of claim 127 wherein the hydrophilic polymer comprises at least one polymer selected from the group consisting of: a polyvinylamine, a poly(vinylamine/vinyl alcohol), and an alkyl acrylate polymer.

136. (Previously Presented) The method of claim 127 wherein the hydrophilic polymer comprises at least one polymer selected from the group consisting of: polydimethylaminoethyl methacrylate, polydimethylaminopropyl methacrylamide, poly(acrylamide/dimethylaminoethyl methacrylate), poly(acrylic acid/dimethylaminoethyl methacrylate), poly(methacrylic acid/dimethylaminoethyl methacrylate), poly(2-acrylamido-2-methyl propane sulfonic acid/dimethylaminoethyl methacrylate), poly(acrylamide/dimethylaminopropyl methacrylamide), poly(acrylic acid/dimethylaminopropyl methacrylamide), and poly(methacrylic acid/dimethylaminopropyl methacrylamide).

137. (Previously Presented) The method of claim 132 wherein the hydrophilic polymer comprises at least one polymer selected from the group consisting of: a cellulose, a chitosan, a polyamide, a polyetheramine, a polyethyleneimine, a polyhydroxyetheramine, a polylysine, a polysulfone, and a starch.

138. (Previously Presented) The method of claim 132 wherein the hydrophobic compound comprises at least one compound selected from the group consisting of: an alkyl halide, a sulfonate, a sulfate, and an organic acid derivative.

139. (Previously Presented) The method of claim 138 wherein the hydrophobic compound comprises the organic acid derivative, the organic acid derivative comprising at least one acid derivative selected from the group consisting of: an octenyl succinic acid, a dodecenyl succinic acid, an anhydride of octenyl succinic acid, an ester of octenyl succinic acid, an amide of octenyl succinic acid, an anhydride of dodecenyl succinic acid, an ester of dodecenyl succinic acid, and an amide of dodecenyl succinic acid.

140. (Previously Presented) The method of claim 132 wherein the hydrophobic compound has an alkyl chain length of about 4 to about 22 carbons.

141. (Previously Presented) The method of claim 127 wherein the hydrophobically modified water-soluble polymer is prepared from a polymerization reaction of at least one hydrophilic monomer and at least one hydrophobically modified hydrophilic monomer.

142. (Previously Presented) The method of claim 131 wherein the hydrophilic monomer comprises at least one monomer selected from the group consisting of: acrylamide, 2-acrylamido-2-methyl propane sulfonic acid, N,N-dimethylacrylamide, vinyl pyrrolidone, dimethylaminoethyl methacrylate, acrylic acid, dimethylaminopropylmethacrylamide, vinyl amine, vinyl acetate, trimethylammoniummethyl methacrylate chloride, methacrylamide, hydroxyethyl acrylate, vinyl sulfonic acid, vinyl phosphonic acid, methacrylic acid, vinyl caprolactam, N-vinylformamide, N,N-diallylacetamide, dimethyldiallyl ammonium halide, itaconic acid, styrene sulfonic acid, methacrylamidoethyltrimethyl ammonium halide, a quaternary salt derivative of acrylamide, and a quaternary salt derivative of acrylic acid.

143. (Previously Presented) The method of claim 141 wherein the hydrophobically modified hydrophilic monomer comprises at least one monomer selected from the group consisting of: an alkyl acrylate, an alkyl methacrylate, an alkyl acrylamide, an alkyl methacrylamide, an alkyl dimethylammoniummethyl methacrylate halide, and an alkyl dimethylammoniumpropyl methacrylamide halide, wherein the alkyl groups have from about 4 to about 22 carbon atoms.

144. (Previously Presented) The method of claim 141 wherein the mole ratio of the hydrophilic monomer to the hydrophobically modified hydrophilic monomer in the hydrophobically modified water-soluble polymer is in the range of about 99.98:0.02 to about 90:10.

145. (Previously Presented) The method of claim 127 wherein the hydrophobically modified water-soluble polymer present in the subterranean formation zone diverts the aqueous injection fluid to a second subterranean formation zone.

146. (Canceled)

147. (Currently Amended) The method of claim 127, wherein the hydrophobically modified water-soluble ~~water-soluble~~ polymer is water soluble.

148. (Canceled)

149. (Previously Presented) The method of claim 106, wherein the relative permeability modifier is water soluble.

150. (Currently Amended) The method of claim 1 wherein the hydrophobically modified water-soluble polymer comprises an a-dialkyl-amino pendant group quaternized to include the hydrophobic branch.

151. (Currently Amended) The method of claim 127 wherein the hydrophobically modified water-soluble polymer comprises an a-dialkyl-amino pendant group quaternized to include the hydrophobic branch.

152-154. (Canceled)

155. (New) The method of claim 106 wherein the amino pendant group comprises a dialkyl amino pendant group.

156. (New) The method of claim 150 wherein the amino pendant group comprises a dialkyl amino pendant group.

157. (New) The method of claim 151 wherein the amino pendant group comprises a dialkyl amino pendant group.